CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

Nineteenth meeting of the Conference of the Parties
Panama City (Republic of Panama), 14 - 25 November 2022

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

Inclusion of *Agalychnis lemur* in Appendix II, in accordance with Article II, Paragraph 2 (a) of the Convention and satisfying Criterion B of Annex 2 a of Resolution Conf. 9.24 (Rev. CoP17), with a zero annual export quota for wild-taken specimens traded for commercial purposes.

B. Proponent

Colombia, Costa Rica, European Union and Panama*

C. Supporting statement

1. Taxonomy

1.1 Class: Amphibia

1.2 Order: Anura

1.3 Family: Hylidae

1.4 Genus, species or subspecies, including author and year: *Agalychnis lemur* (Boulenger, 1882)

A. lemur was originally placed in the genus *Phyllomedusa*; the species was moved to *Hylomantis* by Faivovich *et al.* (2005), then subsequently moved from *Hylomantis* to *Agalychnis* in April 2010 (Faivovich *et al.*, 2010).

A proposal to list the genus *Agalychnis* in Appendix II was successful at CoP15 (CoP15 Prop. 13); however, it explicitly limited the listing to the five species recognised in the genus by the then-valid nomenclatural standard reference, Frost (2004): *A. annae, A. callidryas, A. moreletii, A. saltator* and *A. spurrelli*. At that time, *A. lemur* was recognized as belonging to the genus *Hylomantis* (Faivovich *et al.*, 2005), so was therefore not included in the Appendix II-listing.

The current CITES nomenclatural standard reference for amphibians, Frost (2015), is an extract from 'Amphibian Species of the World', an online reference v.6.0, taken in May 2015, with additional comments by the Nomenclature Specialist of the CITES Animals Committee. Frost (2015) recognised 15 species of *Agalychnis,* including *A. lemur*, which was acknowledged to have caused implementation challenges for the *Agalychnis* spp. listing in its current form. An extract of the current database (Frost, 2021), which recognises 14 *Agalychnis* species, is proposed as a Standard Reference for *A. lemur* (see Annex 1), but also for the *Agalychnis* genus as a whole. Were this to be adopted, the current listing

* *The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat (or the United Nations Environment Programme) concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.*

for *Agalychnis* spp. would be replaced with individual species listings for: *Agalychnis annae, A. callidryas*, *A. lemur*, *A. moreletii, A. saltator, A. spurrelli,* and *A. terranova* (pending the adoption at CoP19 of the recommendation of AC31 to include *A. terranova* as a 6th species).

1.5 Scientific synonyms: *Hylomantis lemur* Boulenger, 1882
Phyllomedusa lemur Boulenger, 1882

1.6 Common names: English: Lemur leaf Frog
Spanish: rana de hoja de lemur; rana lémur

1.7 Code numbers: Not applicable

2. Overview

Agalychnis lemur is a charismatic tree frog occurring in Costa Rica, Panama, and Colombia, associated with sloping areas in humid lowland and montane primary forest. *A. lemur* was historically considered to be a relatively common species in Costa Rica and Panama; however, it is estimated to have undergone a rapid population decline of 80–95% over the past two decades. The species was classified as Critically Endangered by the IUCN in 2020, with habitat loss and the fungal disease chytridiomycosis identified as the likely current drivers of decline; the international pet trade has been identified to have had an impact on the species in the past.

The species occurs in a limited number of locations. According to IUCN, currently only three localities in Costa Rica have confirmed occurrence of *A. lemur*, and the species is reported to have disappeared throughout much of west and central Panama. The three remaining stable populations in Costa Rica are reported by IUCN to occur in privately owned or indigenous reserves, and in Panama the species is thought to occur only in a few sites in the west, with occasional records in central Panama. In Colombia, the status of subpopulations is unknown, with the species thought to be either rare, elusive, or to have a very small population.

A. lemur is available for sale in the international pet trade, although the full extent and nature of the international trade in this species remains uncertain. Imports to the United States of America (hereafter United States) have been reported as captive-bred specimens, with breeding also reported to occur in the European Union. As only a small number of fragmented *A. lemur* populations remain, any collection of wild frogs for the international trade is likely to be detrimental and pose a significant threat to the persistence of this species in the wild. The species' remaining sites in Costa Rica are considered easily accessible and therefore vulnerable to collectors. Due to the species' presence in international trade, its dramatic and rapid recent population decline, and the restriction of the species to a small number of highly fragmented populations, *A. lemur* meets the criteria for inclusion in CITES Appendix II in accordance with Article II, paragraph 2a B of Resolution Conf 9.24 (Rev. CoP17). A zero quota is proposed for wild-taken specimens traded for commercial purposes to ensure that international trade does not further threaten the survival of this Critically Endangered species.

3. Species characteristics

3.1 Distribution

The estimated extent of occurrence for *A. lemur* is 80,005 km^2 (IUCN SSC Amphibian Specialist Group, 2020), with the majority of the current range occurring in Panama (Figure 1). The species has been found at elevations of 440 to 1600m asl in Costa Rica, Panama, and marginally in Colombia (Savage, 2002; Stuart *et al.*, 2008). The species' historical distribution spanned along the Atlantic slopes from Tilarán, northwest Costa Rica, towards western Panama and across the border into Colombia (Figure 1); in 2020, the species' population was described as "severely fragmented" (IUCN SSC Amphibian Specialist Group, 2020).

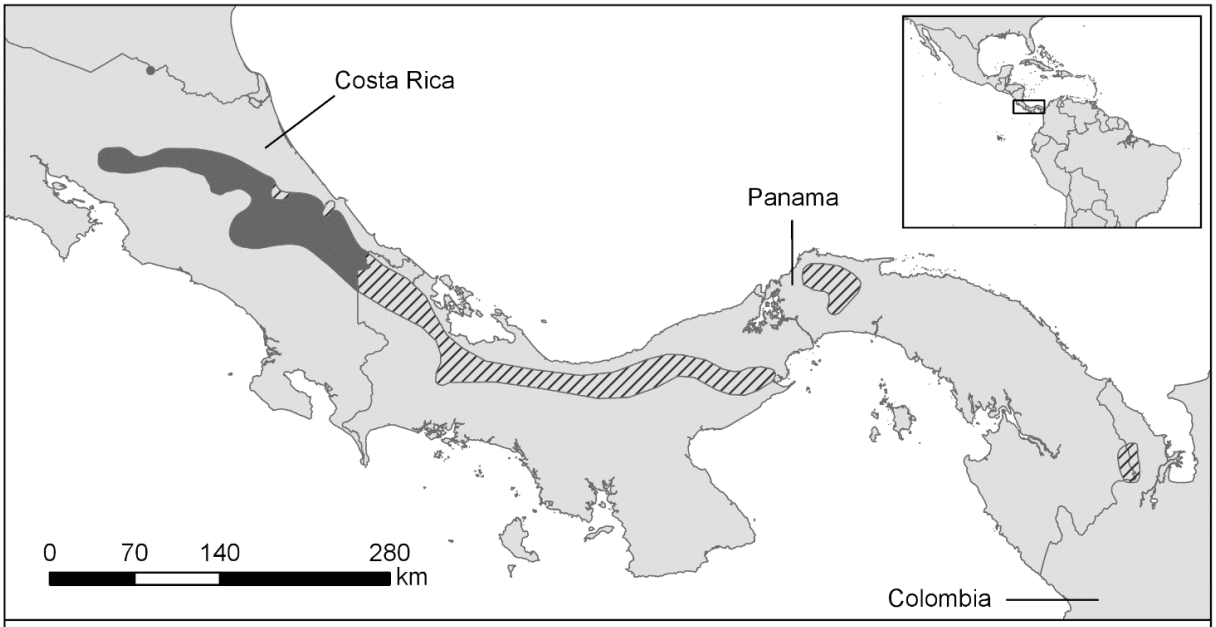

Figure 1: Range map of *Agalychnis lemur*

3.2 Habitat

The species is associated with sloping areas in humid lowland and montane primary forest (Savage, 2002; Stuart *et al.*, 2008), and is reported to be always found near rivers (Costa Rica Red List Assessment Workshop Sep 2019 in: IUCN SSC Amphibian Specialist Group, 2020). Although the species is thought to prefer pristine undisturbed forest (Savage, 2002; Salazar-Zúñiga *et al.*, 2019), surveys in Costa Rica between 2012–2017 observed *A. lemur* in secondary forest and at forest edges (Salazar-Zúñiga *et al.*, 2019).

3.3 Biological characteristics

A. lemur is a nocturnal species, occurring in the upper forest canopy from where it calls (G.F. Medina-Rangel *pers. comm*. February 2019 in: IUCN SSC Amphibian Specialist Group, 2020). It was reported to be active throughout most of the year, with a reproductive season spanning the early rainy season from April to July (Savage, 2002; Stuart *et al.*, 2008). Clutch sizes of between 15 and 70 eggs have been observed in terrariums (Schulte, 1997 in: Savage, 2002; Van Eijsden, 1977 in: Savage, 2002; Jungfer and Weygoldt, 1994; Citizen Conservation, 2019), and Gomez-Mestre *et al.* (2008) observed an average clutch size of 22.5 ± 2.1 eggs in four clutches observed in the field in Limón, Costa Rica. Females were described to produce two to three clutches in one night or may lay clutches on separate nights (Savage, 2002). The eggs are usually deposited on leaf surfaces and larvae are washed off into the water below (IUCN SSC Amphibian Specialist Group, 2020); data from captive specimens indicated they hatch into tadpoles 7-14 days after fertilization, with metamorphosis occurring 69-100 days after fertilization (Jungfer and Weygoldt, 1994; Citizen Conservation, 2019). Generation length in *A. lemur* was reported to be seven years (IUCN SSC Amphibian Specialist Group, 2020).

3.4 Morphological characteristics

A. lemur is a moderate-sized green tree-frog with vertical pupils, yellow–orange flanks, orange thigh surfaces and a white venter (Savage, 2002). As the species lacks webbing between its toes it can be distinguished from other *Agalychnis* species, which possess “well-developed” toe webs (Savage, 2002). At night, its dorsal surface turns from pale green to reddish brown–orange (Savage, 2002). Adult males measure between 30-41 mm in length and adult females measure 39-41 mm in length; however, specimens from Costa Rica have been noted to be smaller than those in Panama and there appears

to be an increase in size from west to east (Savage, 2002). One study has since noted that the populations of *A. lemur* in Costa Rica and Panama are genetically distinct from each other (Gray, 2011).

3.5 Role of the species in its ecosystem

No field studies were found relating to the ecosystem role of *A. lemur*; however, research on other *Agalychnis* species may provide insight into *A. lemur*'s likely ecological interactions. The predation of *A. callidryas* and *A. spurelli* eggs by snakes and wasps is well-documented, and predation of eggs by monkeys and pathogenic fungi has also been reported (Warkentin *et al.*, 2001, 2006; Gomez-Mestre and Warkentin, 2007). *Agalychnis* tadpoles are predated by fish, dragonfly nymphs, aquatic hemipterans, beetle larvae, shrimp, and water spiders (Touchon and Vonesh, 2016); large *Agalychnis* tadpole aggregations may also be targeted by birds such as kingfishers (Wells, 2007). Predators of adult *Agalychnis* treefrogs include birds and reptiles (e.g. snakes and caiman), and ctenid spiders have been observed predating small adults (Donnelly and Guyer, 1994; Güell *et al.*, 2019).

4. Status and trends

4.1 Habitat trends

Habitat loss and fragmentation was considered a threat throughout the species' range (IUCN SSC Amphibian Specialist Group, 2020), with *A. lemur*'s preference for primary forest (Salazar-Zúñiga *et al.*, 2019) making it particularly vulnerable. Areas where the species was historically present in Costa Rica, as well as some of the last remaining known sites for the species, were noted to have been deforested for wood extraction as well as agriculture and livestock ranching (see *Threats* section; Costa Rica Red List Workshop September 2019 in: IUCN SSC Amphibian Specialist Group, 2020). Deforestation and illegal mining were reported to occur in the species' reported range in Colombia (IUCN SSC Amphibian Specialist Group, 2020).

4.2 Population size

Costa Rica: *A. lemur* was once considered common in the montane forests of Costa Rica's Talamanca, Tilarán, and Central mountain ranges (Whitfield *et al.*, 2017). However, Zumbado-Ulate *et al*. (2021) noted that the species appears to have been completely extripated from these latter two ranges. The 2020 IUCN assessment for the species noted that *A. lemur* was only known with certainty from a few locations in the country, all in the Limón province (IUCN SSC Amphibian Specialist Group, 2020). Only one site (Fila Asunción and its associated areas) was thought to have a large breeding subpopulation (Costa Rica Red List Assessment Workshop Sep 2019 in: IUCN SSC Amphibian Specialist Group, 2020).

Panama: Whilst the 2008 IUCN assessment for *A. lemur* noted the species was "reasonably common" in lower elevations in central and eastern Panama (Solís *et al.*, 2008), the 2020 assessment noted that the species could only be found at a few sites in the west of the country, with occasional records from central Panama (IUCN SSC Amphibian Specialist Group, 2020). In a recent survey along the Río Guázaro of the Veraguas province (western Panama), Lotzkat *et al.* (2021) reported the occurrence of a single *A. lemur* specimen. Hertz *et al.* (2012) reported finding a single individual in Cerro Negro, Veraguas (central Panama) on a single occasion, despite visiting the site seven times between 2008 and 2009 at different seasons of the year. A recent record of the species was reported from Chagres National Park in central Panama (V. Acosta-Chaves *in litt.* to UNEP-WCMC, 2020).

Colombia: *A. lemur* was considered either very rare, difficult to see, or to have a very small population size in Colombia (G.F. Medina-Rangel *pers. comm.* Feb 2019 in: IUCN SSC Amphibian Specialist Group, 2020). Only two individuals were observed in July 2014 during surveys between 2012-2016 in Unguía, Chocó, close to the border with Panama (IUCN SSC Amphibian Specialist Group, 2020).

4.3 Population structure

There is no information available to date on the population structure of this species.

4.4 Population trends

The 2020 IUCN assessment estimated that *A. lemur* has experienced a population decline of 80–95% since 1998 (21 years/three generation lengths) on account of the species' disappearance from west and central Panama (IUCN SSC Amphibian Specialist Group, 2020).

Costa Rica: *A. lemur* was once considered common in Costa Rica's Tilarán, Central and Talamanca mountain ranges but most populations were reported to have disappeared over the last two decades (Whitfield *et al.*, 2017; IUCN SSC Amphibian Specialist Group, 2020), with the species now only known with certainty from a limited number of locations in the country (see section 4.2). A study conducted in 2021 suggested that *A. lemur* is experiencing a "stable recovery" across part of its historical range in the country; however, it was noted that *A. lemur* may remain "locally extinct in a large part of its range outside Talamanca [mountain range]" (Zumbado-Ulate *et al*., 2021). The assessment was based on an analysis of patterns of presence-only occurrence records over time rather than population estimates, and occurrence records were sourced from a mixture of the herpetological database MZUCR, Global Biodiversity Information Facility (GBIF), iNaturalist, expert field observations, and peer-reviewed literature (Zumbado-Ulate *et al*., 2021).

Panama: Extensive declines have been recorded in western Panama, including from the Reserva Forestal Fortuna, Chiriquí, with no records from this site since 1999 (K. Lips *pers. comm*. 2007 in: Solís *et al.*, 2008) and from El Copé, Coclé, where the species disappeared in 2010 (K. Lips *pers. comm*. in: AmphibiaWeb, 2021). Brem and Lips (2008) reported the disappearance of *A. lemur* from Santa Fe National Park in 2003 during transect surveys, despite the species being "regularly encountered" in this location in the past.

Colombia: Despite survey efforts in 2012-2016 (see section 4.2), the status of *A. lemur* subpopulations in Colombia was reported to remain unknown (IUCN SSC Amphibian Specialist Group, 2020). No further information was located relating to the species' population trend in Colombia.

4.5 Geographic trends

As indicated in section 4.4, *A. lemur* has disappeared from most of its range, surviving in only a handful of locations in Limón province, Costa Rica and a few sites in west and central Panama. Since 1998, the species has disappeared from areas where it was once considered common, including protected areas (G. Chaves *pers. comm*. 2007, 2019 in: IUCN SSC Amphibian Specialist Group, 2020). Former sites in Costa Rica where the species was known to occur and has since disappeared include Monteverde, San Ramón, Braulio Carrillo National Park, and Tapantí National Park (IUCN SSC Amphibian Specialist Group, 2020).

5. Threats

Declines in *A. lemur* populations are suspected to have been principally caused by chytridiomycosis (an amphibian infectious disease caused by the fungus *Batrachochytrium dendrobatidis* (Bd), as well as habitat loss (IUCN SSC Amphibian Specialist Group, 2020), however the precise cause of the steep declines remains unknown (Rodriguez *et al.*, 2019). The species' vulnerability to chytridiomycosis is unclear, with Whitfield *et al.* (2017) finding a low prevalence (<10%) of chytridiomycosis infection in 20 wild *A. lemur* individuals surveyed in Costa Rica and noting that infection intensity was low in individuals affected. Woodhams *et al.* (2006) predicted that the species may have a high resistance to the chytrid fungus based on studies of its production of antimicrobial skin peptides. Ranaviruses have also been recognised as potential threat to *A. lemur*, however, the effects of these viruses on *A. lemur* are unknown (Rodriguez *et al.*, 2019; IUCN SSC Amphibian Specialist Group, 2020).

Habitat loss and fragmentation are thought to have the potential to have a large impact on *A. lemur* due to the species' preference for primary forest (Stuart *et al.,* 2008; Salazar-Zúñiga *et al*., 2019). In particular, deforestation by squatters was noted to threaten one of the three remaining Costa Rican populations in Fila Asunción (IUCN SSC Amphibian Specialist Group, 2020). Recent surveys conducted in the Costa Rican Veragua Rainforest Park and surroundings found that *A. lemur* had disappeared from certain areas after the intensification of wood extraction during 2013; the authors also noted that a lack of reproductive sites in forests due to habitat degradation promoted the species' use of less suitable breeding sites such as exposed flooding banks or small ponds at the forest edge, increasing the vulnerability of the species (Salazar-Zúñiga *et al*., 2019). In Colombia, deforestation and illegal mining were identified as the main threats in the locations where the species is known to occur (IUCN SSC Amphibian Specialist Group, 2020).

The species is known to be in the international pet trade, with intentional use of wild specimens being reported as a "past impact" (IUCN SSC Amphibian Specialist Group, 2020). Based on the outcomes of the Costa Rican Red List Workshop held in 2019, it was unknown if collection from the wild was still a threat (IUCN SSC Amphibian Specialist Group, 2020), however the species remains in demand for the pet trade, with trade occuring in captive specimens (see section 6.2). Climate change has also been cited as potential threat to the species, the impact of which was also not known (Rodriguez *et al.*, 2019).

6. Utilization and trade

6.1 National utilization

There is no available information on the national utilisation of *A. lemur* in Costa Rica, Panama or Colombia.

6.2 Legal trade

A. lemur is present in the international pet trade, with online listings for specimens reported to have been captive-bred advertised for 50 to 60 USD[1,2,3] and 35 to 60 EUR[4,5,6] (Accessed 28/06/2021). A study commissioned by Germany's CITES Management Authority screened six internet platforms and several Facebook groups between 2017-2018 and found 20 adverts for *A. lemur* on German sites, making the species the second-most popular *Agalychnis* species advertised during the study period (Altherr *et al.*, 2020). A rapid survey of physical and online markets in Japan conducted between January 2020- April 2021 identified *A. lemur* offered for sale, however, no details were available on the number of *A. lemur* specimens observed and whether they were wild-sourced or captive-bred (Kitade and Wakaeo, 2022).

According to US Fish and Wildlife Service Law Enforcement Management Information System (LEMIS) data spanning 2010-2020 provided by the United States, direct imports of *A. lemur* to the United States predominantly comprised 76 live captive-bred individuals imported from Germany during 2016-2020 for commercial purposes. The remainder of imports 2016-2020 consisted of low levels of wild-sourced specimens (two) and unspecified commodities (two) imported from Panama, all for scientific purposes. No indirect imports of *A. lemur* were reported by the United States over this period.

An additional source of LEMIS data, extracted from Eskew *et al.* (2019), covers the period 2000-2014[7] and includes imports reported under the synonyms of *A. lemur*: *Phyllomedusa lemur* and *Hylomantis lemur*. Imports into the United States over this period predominantly consisted of 135 live captive-bred individuals, of which 46% were imported for commercial purposes from Canada. Other imports over this period comprised 10 live wild-sourced individuals, 27 wild-sourced bodies and 3 captive-born bodies, all imported for scientific purposes. Indirect imports of *A. lemur* to the United States 2000-2014 consisted of three captive-bred live individuals originating from Costa Rica which were exported by the United Kingdom to the United States in 2014 for scientific purposes. Over the same period, the United States imported 4594 wild-sourced *Agalychnis* individuals where the species was not identified; 804 of these individuals came from range States of *A. lemur*, the majority of which were exported from Panama in 2001 for commercial purposes (87%). No trade in individuals reported at the genus level (*Agalychnis* spp.) was reported after 2007 for the period spanning 2000-2014.

6.3 Parts and derivatives in trade

Commercial trade is only known to occur in live animals.

1 https://www.shop.jl-exotics.com/Lemur-Leaf-Frog-Hylomantis-lemur-LLF.htm

2 https://www.joshsfrogs.com/lemur-tree-frog-agalychnis-lemur-captive-bred.html

3 https://www.wilbanksreptiles.com/product/lemur-tree-frog-agalychnis-lemur-captive-bred-/4665?cp=true&sa=false&sbp=false&q=false&category_id=81

4 https://www.terraristik.com/tb/kaufen-und-verkaufen/agalychnis-lemur-nz-lemurenlaubfroesche-nachzucht/a922047/

5 https://www.terraristik.com/tb/buy-and-sell/agalychnis-lemur-zuchtgruppe/a921157/

6 https://rana-terrarienbau.de/produkt/agalychnis-lemur/

7 *Obtained via Freedom of Information Act (FOIA) requests by EcoHealth Alliance, available at:* https://zenodo.org/record/3565869#.YeAeotHP1PY

6.4 Illegal trade

Little evidence was located relating to illegal trade in *A. lemur*. One expert expressed doubts as to the legal acquisition of founder stocks for captive populations that are held outside of the species' natural range, noting that specimens have been regularly advertised for sale as originating from founder stock exported during the 1980s (V. Acosta-Chaves *in litt*. to UNEP-WCMC, 2020). It was considered that the localities in which the species is found are relatively easy to access (V. Acosta-Chaves *in litt*. to UNEP-WCMC, 2020), leaving populations potentially vulnerable to illegal trade. At the genus level, the import of over 11,000 specimens of *A. callidryas* and *A. moreletii* from Guatemala into the United States between 1999-2008 was suspected to have been exported illegally; over the same period, the United States imported over 250 specimens of *Agalychnis* spp. from Costa Rica and Honduras, despite restrictions on the export of *Agalychnis* species reported to be in place in these countries (CoP15 Prop.13).

6.5 Actual or potential trade impacts

While habitat degradation and chytridiomycosis are thought to present the main threats to *A. lemur* (IUCN SSC Amphibian Specialist Group, 2020), all other secondary threats further increase the negative pressure on wild populations of this species. As outlined in section 5, the 2020 IUCN assessment noted that it remains unclear whether wild populations of *A. lemur* are currently being harvested for commercial trade. However, data for imports to the United States and online advertisements indicate that *A. lemur* is a target for the international exotic pet trade. Given the scale and rapidity of the species' decline and the restriction of the species to a small number of highly fragmented populations, any collection of wild individuals for international trade would be detrimental to the survival of *A. lemur*. Furthermore, as noted in section 3.4, populations in Costa Rica and Panama are genetically distinct; any trade could endanger these genetically distinct units.

7. Legal instruments

7.1 National

Costa Rica: Wild species in Costa Rica are protected by the Wildlife Conservation Law No. 7317 of 1992 and its implementing Regulation 40548. Article 14 of the law prohibits the removal of endangered species from the wild for all purposes with the exception of sustainable captive breeding in facilities registered with the General Directorate of Wildlife of the Ministry of the Environment and Energy. Article 18 of the law prohibits trade, transfer and export of wild species. Article 112 of the Regulation establishes the only possible destinations for trade in wild animals born in captivity. Commercialisation can only be done from the third generation for endangered species.

Panama: Article 15 of the Panama's Wildlife Law (No. 24) prohibits the use and transport of wildlife unless prior authorization is received from the National Directorate of Protected Areas and Wildlife. *A. lemur* is included as an endangered species in the most recent list that could be located (Resolution No. DM-0657-2016 of 16 December 2016).

Colombia: Export for commercial purposes of live *Agalychnis* species, including *A. lemur*, is prohibited (CITES Management Authority of Colombia *in litt.* to UNEP-WCMC, 2021). *A. lemur* is not included in Colombia's "List of threatened wild species of Colombian biological diversity" in Resolución Nº 192, 2014[8].

7.2 International

No international legal instruments were identified.

8 https://www.ecolex.org/details/legislation/resolucion-no-192-listado-de-las-especies-silvestres-amenazadas-de-la-diversidad-biologica-colombiana-lex-faoc131776/ *(Accessed 05/07/2021)*

8. Species management

8.1 Management measures

An *in situ* conservation effort whereby tadpoles were introduced into artificial ponds at the Costa Rican Amphibian Research Centre in Guayacán has been in place since 2003, with individuals reported to have expanded to other nearby sites that are within the species' historical distribution (V. Acosta-Chaves *in litt*. to UNEP-WCMC, 2020). There have been unsubstantiated reports of attempts to reintroduce the species around Sarapiquí and the Tilarán Mountain Ridge (V. Acosta-Chaves *in litt*. to UNEP-WCMC, 2020). The British Zoological Society, in partnership with the Veragua Rainforest Foundation, has planned a habitat restoration and range determination project in Costa Rica (Amphibian Survival Alliance, 2021).

A. lemur was given high priority status in Panama's 2011 National Action Plan for Amphibians (Direccion de Areas Protegidas y Vida Silvestre, 2011). The plan aims to ensure the conservation of amphibians in the country through (a) scientific surveys to update information on the population trends of species and to better characterise the causes of decline, (b) coordination and funding of conservation actions, including the identification of important protected areas for amphibians, and (c) the implementation of educational programmes that facilitate conservation activities (Direccion de Areas Protegidas y Vida Silvestre, 2011).

No information on national management measures could be identified for Colombia.

8.2 Population monitoring

Ongoing monitoring was reported to be taking place for *A. lemur* subpopulations in Costa Rica (G. Chaves *pers. comm*. Sep 2019 in: IUCN SSC Amphibian Specialist Group, 2020). Fundación Veragua Rainforest was reported to be monitoring the Veragua Rainforest population (V. Acosta-Chaves *in litt*. to UNEP-WCMC, 2021), and a number of surveys to look for *A. lemur* in locations beyond its confirmed sites of occurrence in Costa Rica were reported to be planned or underway, including one to assess the species presence throughout its historical range in Costa Rica's Central Valley (Mohamed bin Zayed Species Conservation Fund, 2020). Monitoring of sites including Río Macho Biological Station, Reserva San Ramón, and El Silencio de Los Ángeles Cloud Forest, did not result in any records (V. Acosta-Chaves *in litt*. to UNEP-WCMC, 2021).

Project Lemur Frog facilitated the creation of a small research station in the Costa Rican Rio Vereh Cloud Forest Reserve in 2015 to encourage amphibian research in the area (Project Lemur Frog, 2017). The British Zoological Society, in partnership with the Veragua Rainforest Foundation, is aiming to conduct a wider survey of Hitoy Cerere National Park, Costa Rica, to identify any additional isolated *A. lemur* populations in the country (Amphibian Survival Alliance, 2021).

No further specific information was found regarding the monitoring of the species' population status.

8.3 Control measures

8.3.1 International

No international control measures for this species were identified.

8.3.2 Domestic

No control measures for this species were identified, beyond the legal instruments outlined in section 7,1.

8.4 Captive breeding and artificial propagation

A number of *ex situ* breeding programmes are in place for *A. lemur*. The first captive breeding population was established in the Atlanta Botanical Garden in the United States in 2001 (Petchey *et al.*, 2014; Citizen Conservation, 2019), which as of April 2014 held a captive population of 152 individuals (Gratwicke *et al.*, 2016). Frogs produced from this captive breeding project were also transferred to AZA zoos in the US, totalling 241 captive frogs across 19 AZA zoos (Gratwicke *et al.*, 2016). An *ex situ* population of 60 individuals was present at the El Valle Amphibian Conservation Center (EVACC) in

Panama in April 2014 (Gratwicke *et al.*, 2016). In 2018, EVACC reported that they held 105 *A. lemur* adults descended from 11 founders (Amphibian Ark, 2021).

Project Lemur Frog was established in 2012 as an international collaboration between institutions and individuals seeking to conserve the species through collaborative research, *in situ* and *ex situ* conservation, and public engagement and education (Lemur Leaf Project, 2021). Through the project, an *ex situ A. lemur* population representing three distinct bloodlines was transferred from Manchester Museum and Bristol Zoo to Nordens Ark, Sweden in 2016 with the aim of maintaining an assurance population (Project Lemur Frog, 2017). Manchester Museum, Bristol Zoo and Nordens Ark continue to maintain captive breeding facilities for *A. lemur*[9,10,11]. The European Studbook (ESB) for *A. lemur,* is maintained and coordinated by Bristol Zoo (Citizen Conservation, 2019; EAZA, 2021).

As of July 2021, no licensed commercial captive breeding facilities for *A. lemur* were reported in Colombia (CITES Management Authority of Colombia *in litt.* to UNEP-WCMC, 2021).

8.5 Habitat conservation

A 2008 ecological niche modelling study estimated that approximately 37% of *A lemur's* predicted geographic range fell within protected areas (IUCN category I–IV) (Urbina-Cardona and Loyola, 2008).

A. lemur's former range in Costa Rica included several national parks and protected areas, however none of the remaining subpopulations were reported to be within these areas in 2020 *(G. Chaves pers. comm*. 2007, 2019 in: IUCN SSC Amphibian Specialist Group, 2020). While there are no subpopulations reported in national parks, all three of the species' remaining stable populations were reported to be located within private biological reserves and an indigenous reserve (G. Chaves *pers. comm.* 2019 in: IUCN SSC Amphibian Specialist Group, 2020; V. Acosta-Chaves *in litt*. to UNEP-WCMC, 2020). Concerns were raised at the Costa Rica Red List Workshop (September 2019) that the remaining subpopulations located on private land could be at risk if ownership were to change in the future (IUCN SSC Amphibian Specialist Group, 2020). Through Project Lemur Frog, the Manchester Museum (UK) funded the clearing of ponds and understory of undesirable ferns within Guayacán Rainforest Reserve, a private reserve operated by the Costa Rican Amphibian Research Center (Project Lemur Frog, 2017). A habitat restoration project in Veragua Rainforest, Costa Rica is planned with the British Zoological Society in partnership with the Veragua Rainforest Foundation. The project intends to establish suitable breeding habitats in the form of artificial pools in accessible areas to promote colonisation and use of sites beyond the species' known area of occurrence (Amphibian Survival Alliance, 2021). No habitat conservation programmes outside of protected areas in Costa Rica were identified.

In Panama, *A. lemur* was reported to be present in at least six protected areas in 2020 (IUCN SSC Amphibian Specialist Group, 2020), but further details of these protected areas could not be located. There is one recent record of the species in Chagres National Park (V. Acosta-Chaves *in litt*. to UNEP-WCMC, 2020). No habitat conservation programmes outside protected areas were identified.

A. lemur is not known from any protected areas in Colombia (Solís *et al*., 2008).

8.6 Safeguards

National legislation is in place in two of *A. lemur*'s range States to protect the species (see section 7.1).

9. Information on similar species

Other members of the genus *Agalychnis* are prominent in trade; *Agalychnis callidrya*s in particular was among the top 15 most traded amphibians in the United States over the period 2001-2009 (Herrel and van der Meijden, 2014). According to the CITES Trade Database, global trade for commercial purposes in the five species of *Agalychnis* in Appendix II between 2009 and 2018 was principally in captive bred live specimens of *A. callidryas*, with smaller numbers of *A. spurelli* and *A. annae*. Nicaragua was by far the largest exporter, with Costa Rica and Colombia both exporting relatively low numbers of captive bred specimens. Direct commercial trade in *A. callidryas* into the EU between 2009-2018 totalled approximately

9 https://www.museum.manchester.ac.uk/collection/vivarium/ *(Accessed 22/06/2021)*

10 https://bristolzoo.org.uk/explore-the-zoo/lemur-leaf-frogs *(Accessed 22/06/2021)*

11 https://en.nordensark.se/conservation/lemur-leaf-frog/ *(Accessed 22/06/2021)*

20 000 live individuals. Low levels of wild-sourced bodies and specimens traded for scientific purposes were also reported by exporters over this period.

Following Amphibian Species of the World, an Online Reference V. 6.1, the genus *Agalychnis* consists of 14 named species. *A. lemur* was reported to be easily distinguishable from other Phyllomedusidae from Central and South America (V. Acosta-Chaves *in litt*. to UNEP-WCMC, 2020); the lack of webbing between the toes of *A. lemur* is considered to be a distinctive feature of *A. lemur* (Costa Rican Amphibian Research Center, 2021), in contrast to other *Agalychnis* species which are noted to possess "definite finger and toe webs" (Savage, 2002). To help distinguish between the five CITES Appendix II listed *Agalychnis* species and other treefrogs within the genus which are not covered by this listing, Mexico's Scientific Authority (CONABIO) produced an identification guide which details the morphological differences between each species[12,13].

10. Consultations

The European Union consulted with the range States initially in May 2021, and then subsequently in August/October 2021.

11. Additional remarks

12. References

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12 https://www.biodiversidad.gob.mx/media/1/planeta/cites/files/cartel_ranas_CITES_v7_en.pdf *(Accessed 28/06/2021)*

13 https://www.biodiversidad.gob.mx/media/1/planeta/cites/files/Guia_ranas_CITES_ing_web.pdf *(Accessed 28/06/2021)*

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Annex 1

Note: The accepted family for *A. lemur* (Phyllomedusidae) according to Frost (2020) is different to that in the CITES Appendices, where *Agalychnis* is considered to belong to the Hylidae family. Given that the taxonomy of tree frogs remains in flux, this proposal includes *A. lemur* under the family for *Agalychnis* currently shown in the Appendices (Hylidae).

Proposed CITES Standard Reference for *Agalychnis* spp.:

Extract from Frost, D.R. 2021. Amphibian Species of the World: an Online Reference. Version 6.1. Available at: https://amphibiansoftheworld.amnh.org/index.php. [Accessed: 20/07/2021]. American Museum of Natural History, New York, USA. doi.org/10.5531/db.vz.0001

Agalychnis Cope, 1864
Class: Amphibia > Order: Anura > Family: Phyllomedusidae > Genus: Agalychnis

14 species

Agalychnis Cope, 1864, Proc. Acad. Nat. Sci. Philadelphia, 16: 181. Type species: *Hyla callidryas* Cope, 1862, by original designation. Designation of *Agalychnis moreletii* as the type species of *Agalychnis* by Taylor, 1952, Univ. Kansas Sci. Bull., 35: 801, and the comments by Duellman, 1970, Monogr. Mus. Nat. Hist. Univ. Kansas: 87, are in error; see Cope, 1864, Proc. Acad. Nat. Sci. Philadelphia, 16: 181, and Taylor, 1955, Univ. Kansas Sci. Bull., 37: 525.

Pachymedusa Duellman, 1968, Univ. Kansas Publ. Mus. Nat. Hist., 18: 5. Type species: *Phyllomedusa dacnicolor* Cope, 1864, by original designation. Synonymy by Faivovich, Haddad, Baêta, Jungfer, Álvares, Brandão, Sheil, Barrientos, Barrio-Amorós, Cruz, and Wheeler, 2010, Cladistics, 26: 258.

English Names

Leaf Frogs (Liner, 1994, Herpetol. Circ., 23: 16; Frank and Ramus, 1995, Compl. Guide Scient. Common Names Amph. Rept. World: 51; Liner and Casas-Andreu, 2008, Herpetol. Circ., 38: 7).

Mexican Giant Tree Frogs (*Pachymedusa* [no longer recognized]: Ananjeva, Borkin, Darevsky, and Orlov, 1988, Dict. Amph. Rept. Five Languages: 66).

Mexican Leaf Frogs (*Pachymedusa* [no longer recognized]: Liner, 1994, Herpetol. Circ., 23: 25; Liner and Casas-Andreu, 2008, Herpetol. Circ., 38: 19).

Rough Leaf Frogs (*Hylomantis* [no longer recognized]: Frank and Ramus, 1995, Compl. Guide Scient. Common Names Amph. Rept. World: 58).

Middle American Multicolored Treefrogs (Hedges, Powell, Henderson, Hanson, and Murphy, 2019, Caribb. Herpetol., 67: 13).

Distribution

Pacific lowlands of Mexico from southern Sonora south, including the Balsas Depression to the state of Mexico, to the Isthmus of Tehuantepec; tropical southern Mexico, Central America, Pacific lowlands of Colombia and northwestern Ecuador; Upper Amazon Basin and lower Andean slopes in Colombia, Venezuela, and northeastern Peru, likely into eastern Ecuador.

Comment

For discussion see Duellman, 1970, Monogr. Mus. Nat. Hist. Univ. Kansas: 81-128. Faivovich, Haddad, Baêta, Jungfer, Álvares, Brandão, Sheil, Barrientos, Barrio-Amorós, Cruz, and Wheeler, 2010, Cladistics, 26: 227-261, recently revised the genus within a larger treatment of the subfamily. Pyron and Wiens, 2011, Mol. Phylogenet. Evol., 61: 543-583, in their study of Genbank sequences, confirmed the results of Faivovich et al., 2010, but retained a paraphyletic H*ylomantis* and did not accept the synonymy

of *Pachymedusa* and *Hylomantis.* Köhler, 2011, Amph. Cent. Am.: 198–201, provided a key to the species of Central America and provided a map and photograph of the species.

Contained taxa (14 sp.):

Agalychnis annae (Duellman, 1963)

Agalychnis buckleyi (Boulenger, 1882)

Agalychnis callidryas (Cope, 1862)

Agalychnis dacnicolor (Cope, 1864)

Agalychnis danieli (Ruiz-Carranza, Hernández-Camacho, and Rueda-Almonacid, 1988)

Agalychnis hulli (Duellman and Mendelson, 1995)

Agalychnis lemur (Boulenger, 1882)

Agalychnis medinae (Funkhouser, 1962)

Agalychnis moreletii (Duméril, 1853)

Agalychnis psilopygion (Cannatella, 1980)

Agalychnis saltator Taylor, 1955

Agalychnis spurrelli Boulenger, 1913

Agalychnis taylori Funkhouser, 1957

Agalychnis terranova Rivera-Correa, Duarte-Cubides, Rueda-Almonacid, and Daza-R., 2013